A SYSTEMATIC STUDY OF THE MAIN ARTERIES IN THE REGION OF THE HEART—AVES XXI.

PASSERIFORMES—PARIDAE. PART 1[1]

FRED H. GLENNY[2]

As Garrod (1873) has already pointed out, the Passeriformes are characteristically "aves laevo-carotidinae," but as the present writer has shown in several recent papers, in certain orders of birds (Glenny, 1940, 1942 and 1943a, and Glenny, unpublished papers) the arrangement of the internal carotid arteries cannot be entirely utilized as an ordinal character. Furthermore, as has been shown in other recent studies (Glenny, 1943b, 1943a, and 1944) there may be characteristic family variations of the basic ordinal arterial arrangement-pattern within an order—aside from certain minor individual or specific differences—which may be used in gross anatomical and perhaps in phylogenetic studies.

It is of particular interest, therefore, to determine, in so far as possible, the family arrangement-patterns of the main arteries in the neck and thorax of the Passeriformes. The present study is limited to a consideration of the arterial arrangements of four species of the Paridae.

MATERIALS

The species used in this study were collected by Professor Tsen-Hwang Shaw, Fan Memorial Institute of Biology, Peiping, China; the Division of Ornithology, Cleveland Museum of Natural History; and the author.

Single specimens of *Parus major artatus* (Thayer & Bangs) and *Parus palustris hellmayri* (Bianchi), and two specimens of both *Parus atricapillus* L. and *Baeolophus bicolor* L. were dissected and diagrams prepared.

The following observations are based upon the information obtained in the study of the above specimens.

OBSERVATIONS

The basic family arterial arrangement-pattern for the species studied is characteristic.

The aortic root (1) arises in the left ventricle, passes anteriorly and diagonally to the right for a short distance before bifurcating to form the innominate arteries (2). The functional (right) systemic (4th aortic) arch (3) arises from the right innominate artery near its base. The systemic arch connects directly with the right radix aortae (4) which passes posteriorly and diagonally from the right toward the centre where it becomes the dorsal aorta (7). The ligamentum aortae (5) remains as an extremely small ligament and the proximal attachment to the pulmonary artery (6) may atrophy completely.

The innominate arteries pass anteriorly and diagonally to the right and left and then divide to form the subclavian (9) and common carotid (8) arteries. The subclavian artery sends off the intercostal (10)—from the posterior face—, coracoid major (11)—from the ventral face—, axillary (12)—from the anterior face—, and two pectoral (13) arteries.

The common carotids give rise to a short thyroid artery (21) before giving rise to the superficial cervical (14), vertebral (15), and internal carotid (18 and 19) arteries. The ductus shawi (16) arises from the vertebral artery, near its origin

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[1]Contributions from the Department of Zoology, University of Toronto.

[2]Formerly Assistant, Department of Zoology, University of Toronto; now on active service with the U. S. Army Medical Department.

from the common carotid artery, and sends off the syringo-tracheal branches (17) before passing posteriorly to supply the oesophagus, bronchi, and connective tissues in the region of the heart.

The superficial cervical arteries supply the muscles, glands, and accessory tissues of the neck; the right vessel also sends branches to the oesophagus. The right internal carotid becomes functionally modified as the ascending-oesophageal artery (19), while the left internal carotid (trunk) artery (18) alone enters the hypapophysial canal to carry the major cephalic blood supply.

Except in *Baeolophus bicolor*, the scapular arteries arise from the superficial cervical arteries, but in *Baeolophus* the right scapular artery arises from the ascending-oesophageal artery, and the left scapular artery arises from the left vertebral artery or from the left superficial cervical which (in this case) arises from near the base of the left vertebral artery. This may be an individual difference and may vary somewhat in different specimens.

The right ligamentum botalli atrophies completely or fuses entirely with the right radix aortae and is, as a result, entirely lacking.

DISCUSSION

From the above observations it is readily seen that—in so far as the present study is concerned—there is a fundamental and essential similarity in the arrangement of arteries in the neck and thorax of the Paridae. It will be noted further that the species of *Parus* are identical in arrangement, and differ but slightly from *Baeolophus bicolor* in so far as secondary vessels are concerned.

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(Unpublished papers):

(a) A systematic study of the main arteries in the region of the heart—Aves XII. Galliformes, Part 1. (In press.)

(b) A systematic study of the main arteries in the region of the heart—Aves XIII. Ciconiiformes, Part 1. (In press.)

(c) A systematic study of the main arteries in the region of the heart—Aves XVII. Colymbiformes, Part 1. (In press.)

(d) The main arteries in the neck and thorax of five species of Parrots.

EXPLANATION OF FIGURES IN PLATE

1, Aortic root; 2, Innominate arteries; 3, Right systemic arch; 4, Radix aortae; 5, Ligamentum aortae; 6, Pulmonary artery; 7, Dorsal aorta; 8, Common carotid artery; 9, Subclavian artery; 10, Intercostal artery; 11, Coracoid major artery; 12, Axillary artery; 13, Pectoral arteries; 14, Superficial cervical artery; 15, Vertebral artery; 16, Ductus shawi; 17, Syringotracheal arteries; 18, Left internal carotid (trunk) artery; 19, Ascending-oesophageal (right internal carotid) artery; 20, Scapular artery; 21, Thyroid artery.

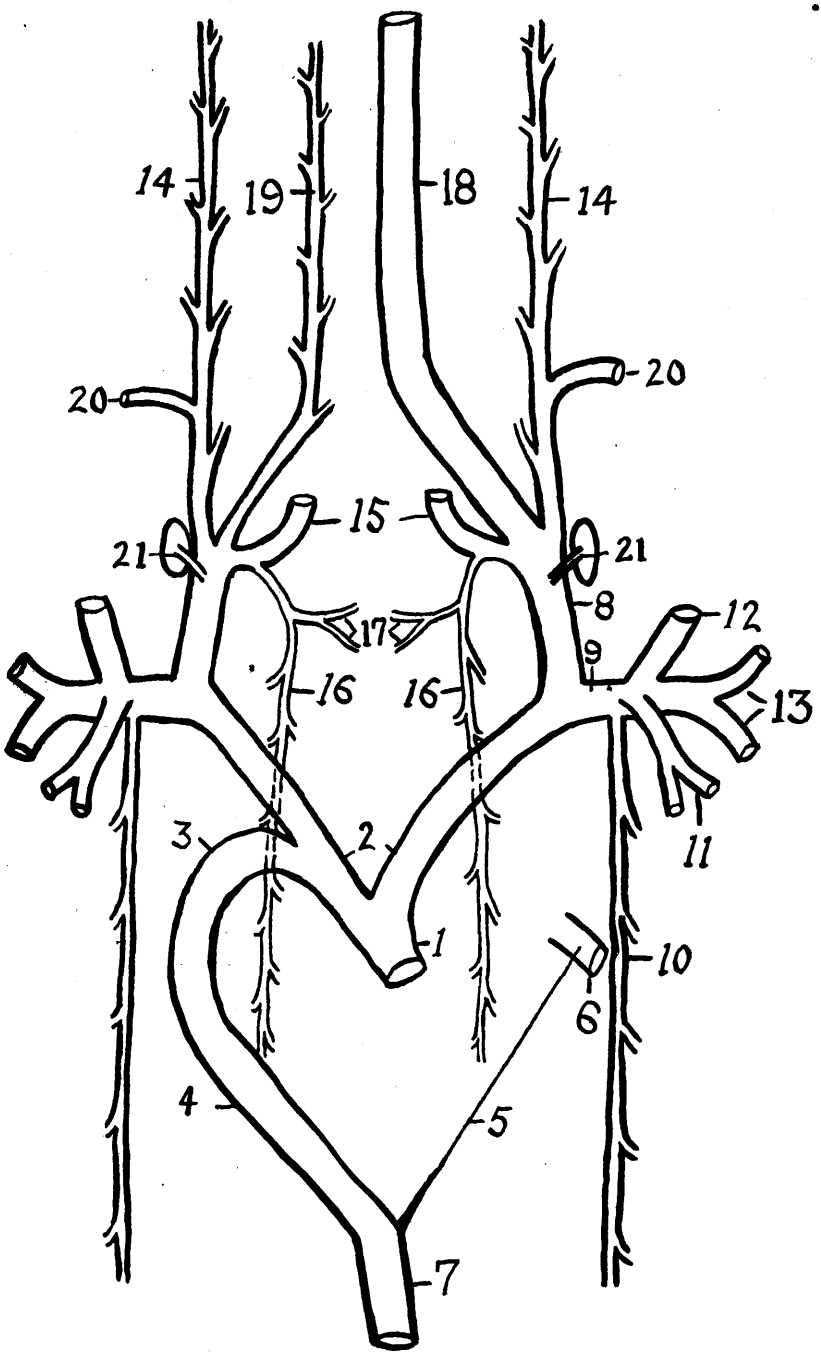

Diagram of the main arteries in the neck and thorax of *Parus palustris hellmayri*. Ventral view.